wherein a first member is provided which is located in the annular passage and which is constructed of material which is more susceptible to wear than the material of which the interfacing surfaces of the elements are constructed, there being clearance between the first member and the interfacing surfaces so that the first member is able to move both radially and axially in the annular passage.--

REMARKS

The specification has been amended to make editorial changes to place the application in condition for allowance at the time of the next Official Action.

Claims 12-23 were previously pending in the application. Claim 14 is cancelled and new claim 24 is added. Therefore, claims 12, 13 and 15-24 are presented for consideration.

Applicant would like to thank the Examiner for indicating allowable subject matter in claims 22 and 23. In reliance thereon, claim 22 is rewritten in independent form as new claim 24.

Claim 23 is amended to address the 35 USC §112, second paragraph rejection noted in the Official Action.

Claims 12-15, 19 and 20 are rejected as being anticipated by BUDZICH et al. 4,353,559.

Reconsideration and withdrawal of the rejection are respectfully requested because the reference does not disclose or suggest an annular passage defined by interfacing surfaces of respective elements between which there is a clearance such as to enable pulverulent material entrained in the fluid to enter the annular passage when the apparatus is in use and to be deposited in layers which build up so that there is formed between the layers a labyrinthine passage having a width which is substantially smaller than the clearance between the interfacing surfaces and is such that the flow of fluid through the labyrinthine passage is substantially restricted as recited in claim 13 of the present application.

By way of example, page 11, lines 1-12 of the present application disclose that the clearance is substantially greater than the clearance along the interface between the rotors and stators of conventional labyrinth seals. The clearance must be large enough to allow dust or other finely divided solid material which is suspended in the air or other fluid contained in the vessel of the screw conveyor to migrate into the passage where it is deposited on those interfacing portions of the rotor and stator which define the passage. After the seal has been in use for some time the deposited material builds up in layers. The thickness of these layers increase to the point where the effective width of the passage is reduced to a substantial extent. Eventually the layers come into contact with each other

as the rotor rotates, limiting further buildup of the layers. At this point the passage is properly "labyrinthine" in that it is so small in width that, effectively, none of the fluid can pass therethrough.

In contrast, BUDZICH et al. at column 3, lines 17-30, for example, disclose an initial labyrinthine passage that inhibits material (dust particles) from making progress towards bearing house members 46. Accordingly, the interfacing seal members 60 and 62 of BUDZICH et al. are spaced initially so close together that hardly any dust particles enter the path (clearance) between the interfacing seal members 60 and 62. As further disclosed by BUDZICH et al., some dust particles do enter the clearance and cause seal member 66 to wear. As this wearing progresses, the spacing enlarges enabling even more material to enter the tortuous path of the interfacing members.

In addition, column 3, lines 31-34 of BUDZICH et al. disclose periodically replacing seal members 66 to prevent the opening between rotating seal member 66 and the bearing housing 46 from becoming too large.

Accordingly, BUDZICH et al. teach the opposite of what is recited in claim 13 in that an initially small passage is made large where as in claim 13, an initially large passage is made smaller by the pulverulent material entrained in the fluid which enters the annular passage being deposited in layers which substantially restrict flow of the fluid through the annular

passage. As the reference does not disclose that which is recited, the anticipation rejection is not viable. Reconsideration and withdrawal of the rejection are respectfully requested.

Claims 15, 19 and 20 depend from claim 13 and further define the invention and are also believed patentable over BUDZICH et al.

Claim 12 recites a method of providing a seal between first and second relatively rotatable parts by depositing pulverulent material entrained in the fluid which enters an annular passage to form a labyrinthine passage to substantially restrict flow of the fluid through the annular passage when the mechanism is in use. Accordingly, the method as recited in claim 12 is to intentionally increase the amount of material entering the annular passage so that the material forms a labyrinthine passage having a smaller width than the clearance between the interfacing surfaces to substantially restrict flow of fluid through the annular passage.

BUDZICH et al. teach minimizing the amount of pulverulent material deposited in the annular passage stating that depositing large amounts of pulverulent material will lead to an increased flow in the annular passage which is undesirable. The comments above regarding claim 13 are equally applicable to claim 12. Accordingly, reconsideration and allowance of claim 12 are respectfully requested.

Claims 16-18 and 21 are rejected as unpatentable over BUDZICH et al. This rejection is respectfully traversed.

Claims 16-18 and 21 depend from claim 13 and further define the invention and are also believed patentable over BUDZICH et al.

In addition, MPEP §2143.01 states that if a proposed modification would render the prior art invention being modified unsatisfactory for its intended purpose, then there is no suggestion or motivation to make the proposed modification. *In re Gordon*, 733 F.2d 900, 221 USPQ 1125 (Fed. Cir. 1984).

The Official Action has indicated that the dimensions recited in claims 16-18 and 21 would be considered a design choice. However, the recited ranges are intentionally large. At column 3, lines 17-30 of BUDZICH et al. teach that as the width of the passage increases, the seal becomes less effective. Accordingly, the recited dimensions would make BUDZICH et al.'s seal less effective and thus render BUDZICH et al. unsatisfactory for its intended purpose. Therefore, the recited ranges are not a design choice and one of ordinary skill in the art would not modify BUDZICH et al. to include these ranges.

By way of further explanation, an object of the present invention, similarly to that in BUDZICH et al., is to prevent the penetration of dust particles between the faces of the seal. BUDZICH et al. approach this problem by following convention and making the clearance between the faces of the seals as small as

possible to reduce the amount of particles that enter the passage. Such an approach results in an increased clearance as more particles enter into the passage. As the clearance increases, the rate of deterioration increases and eventually the seal will fail.

Applicant acknowledges that this approach is known and offers an alternative approach not recognized in the prior art.

Applicant submits herewith a declaration explaining the problems faced in the art including how a conventional labyrinth seal operates and how applicant arrived at his solution. As noted in the declaration, the solution proposed by applicant is counterproductive in terms of what was conventional thinking at the time including what is disclosed by BUDZICH et al.

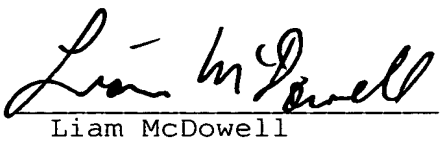
Accordingly, applicant's approach to preventing dust particles from penetrating between the faces of a seal as set forth in claims 12, 13 and 15-24 of the present application is believed patentable over the cited prior art.

In view of the present amendment, the foregoing remarks and applicant's declaration, it is believed that the present application has been placed in condition for allowance. Reconsideration and allowance are respectfully requested.

Attached hereto is a marked-up version showing the changes made to the specification and claims. The attached page is captioned "VERSION WITH MARKINGS TO SHOW CHANGES MADE."

Respectfully submitted,

YOUNG & THOMPSON

By 

Liam McDowell
Attorney for Applicant
Registration No. 44,231
745 South 23rd Street
Arlington, VA 22202
Telephone: 703/521-2297

April 21, 2003

"VERSION WITH MARKINGS TO SHOW CHANGES MADE"

IN THE SPECIFICATION:

Page 10, the paragraph, beginning on line 19, has been amended as follows:

--When the seal has been assembled the flange 68 is located in the recess 44. The thickness of the flange 68 is such that there is clearance between the inner radial face 71 of the flange 68 and the outer face 40a of the rotor [ring] fin 38. Similarly, the thickness of the flange 84 is such that, when it is located in the recess 42, there is clearance between the inner radial face of the flange 84 and the outer face 40a of the rotor [ring] fin 36. Furthermore, the thickness of the flange 78 is such that, when it is located in the channel 46, there is clearance between each of the radial faces of the flange 78 and the inner faces 40b of the respective [rings] fins 36, 38. There is also clearance between the inner ends of the flanges 68, 78, 84 and the interfacing parts of the outer face 92 of the rotor hub 34.--.

Page 21, the paragraph, beginning on line 11, has been amended as follows:

--Referring to Figure 7, the assembly 400 has a setting ring 350 located between the flange 68' of the ring 60' of the [rotor] stator and the [stator] rotor fin 38'. Similarly there is a second setting ring 352 between the flange 84' of the stator ring 64' and the rotor fin 36'. The outer faces of these setting

rings are located in annular recesses machined in the inner radial faces of the respective flanges 68', 84'. The inner faces of the setting rings are located adjacent the outer faces 92', 92'' of the rotor hub 34' and the outer radial faces of the respective fins 38', 36'. The setting rings are of Teflon material. They are sacrificial and their function is similar to that of the setting rings 79, 90 of the assembly shown in Figure 1. However, the dimensions of the setting rings 350, 352 are such that, by design, initially there is clearance all round between each setting ring and the adjacent parts of the rotor and the stator. In larger seal assemblies, this clearance is typically 3 mm all round. Thus, each setting ring 350, 352 is initially able to move by as much as 6 mm both radially and axially when the shaft is turning. As happens in the assembly 100, the setting rings soon wear away and the sealing function is taken over by the layers of solid material which build up on the interfacing surfaces of the rotor and the stator in the passage.

IN THE CLAIMS:

Claim 12 has been amended as follows:

--12. (amended) A method of providing a seal between first and second relatively rotatable parts of a mechanism used in an environment comprising pulverulent material entrained in a fluid, including the steps of:

providing a seal comprising a first element and a second element between which an annular passage is defined when

the first element is mounted on one said part of the mechanism and the second element is mounted on the other said part of the mechanism and the one part is rotated with respect to the other, [CHARACTERISED IN THAT] the annular passage [is] being defined by interfacing surfaces of the respective elements between which there is a clearance; and [on which, when the mechanism is in use,]

depositing pulverulent material entrained in the fluid which enters the annular passage [is deposited in layers which] to form a labyrinthine passage having a width which is substantially smaller than the clearance to substantially restrict flow of the fluid through the annular passage when the mechanism is in use.--

Claim 13 has been amended as follows:

--13. (amended) Apparatus for providing a seal between first and second relatively rotatable parts of a mechanism used in an environment comprising pulverulent material entrained in a fluid, the apparatus comprising:

a first element and a second element between which an annular passage is defined when the first element is mounted on one said part of the mechanism and the second element is mounted on the other said part of the mechanism and the one part is rotated with respect to the other,

[CHARACTERIZED IN THAT] wherein the annular passage is defined by interfacing surfaces of the respective elements

between which there is a clearance [and on which, when the mechanism is in use,] such as to enable pulverulent material entrained in the fluid [which enters] to enter the annular passage [can] when the apparatus is in use and to be deposited in layers which [substantially restrict] build up so that there is formed between the layers a labyrinthine passage having a width which is substantially smaller than the clearance between the interfacing surfaces and is such that the flow of fluid through the [annular] labyrinthine passage is substantially restricted.--

Claim 23 has been amended as follows:

--23. (amended) Apparatus according to claim 13, [in which] wherein the first element is a rotor and the second element is a stator and further comprising second and third members [are] provided [which are located] in the annular passage [which] that are constructed of material which is more susceptible to wear than the material of which the interfacing surfaces of the elements are constructed, the second member being seated on the stator and the third member being seated on the rotor so as to rotate therewith with respect to the second member, there being clearance between the second member and the third member so that the third member is able to move radially with respect to the second member when the rotor rotates.--